

4. On the Natural History of Christmas Island, in the Indian Ocean. By J. J. LISTER, M.A., F.Z.S.

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I. INTRODUCTION.

H.M. Surveying-vessel 'Egeria' left Batavia early on the morning of the 27th September, 1887, to carry a line of deep soundings across the Indian Ocean to Mauritius and to visit Christmas Island on the way.

In January of the same year a short visit had been paid to the island by H.M. Surveying-vessel 'Flying-Fish.' The collections which were made on that occasion exhibited a remarkable degree of peculiarity in the animal inhabitants<sup>1</sup> and showed that a longer visit to the island would probably yield some interesting results.

I was appointed by the Lords of the Admiralty to join the 'Egeria' as naturalist during this part of her cruise, and went out from England to Colombo, where I found that she had already arrived.

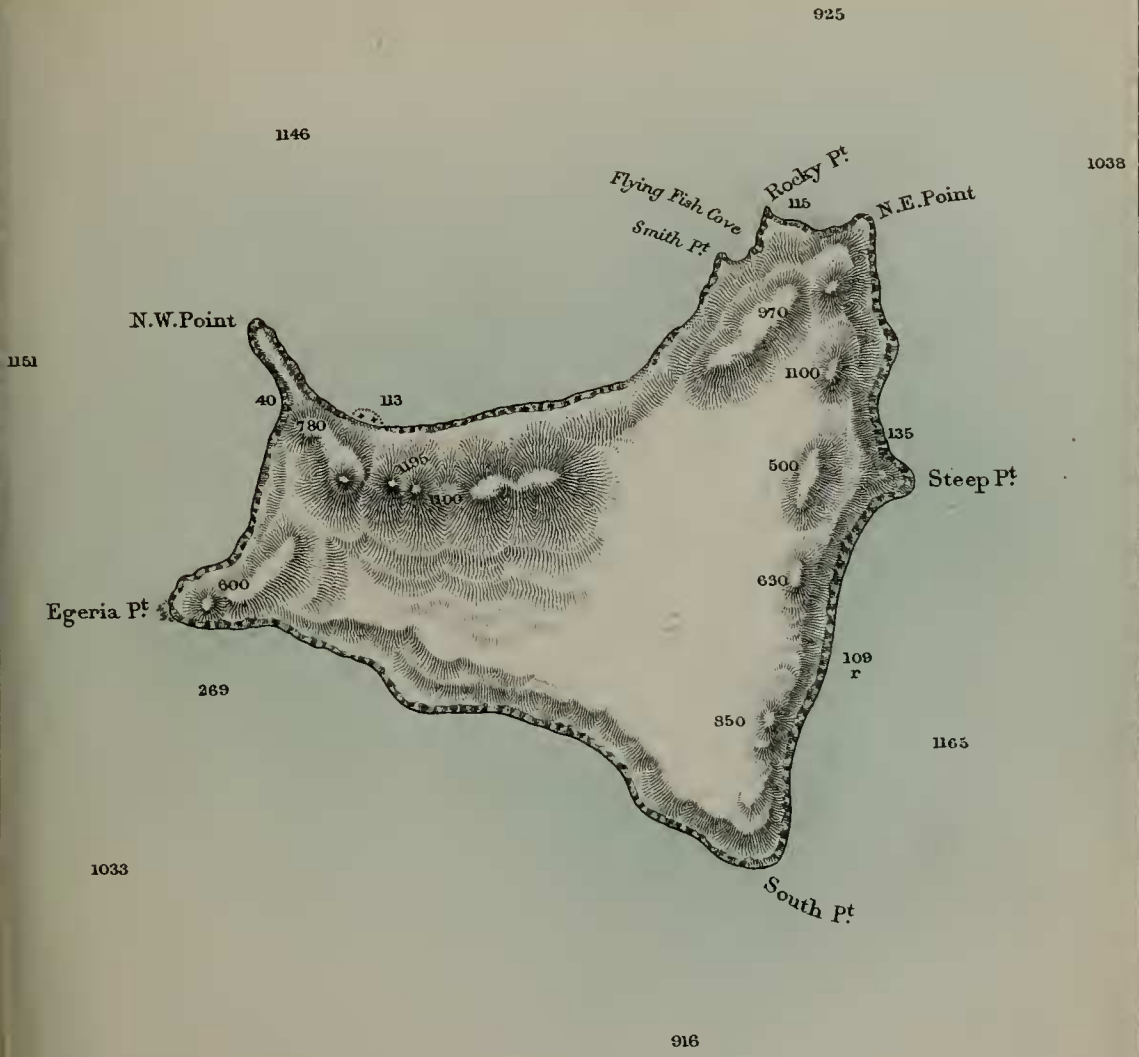
On the way to Batavia we crossed the Bay of Bengal and passed along the Straits of Malacca to Singapore, and thence through the narrow channel between Banca and Sumatra to Batavia.

Leaving Batavia we entered the Straits of Sunda. To the east the Javan hills sloped steeply to the sea, scored with many valleys and ridges, and the rich red volcanic earth brightly variegated with green crops. At their feet was the town of Anjer and the line of coast which suffered so terribly from the explosion of Krakatoa in 1883, while above the first of the great conical mountains of Java now and then loomed out from the clouds. To the westward and more distant a high volcanic peak on Sumatra rose above the nearer islands, and later in the day Krakatoa itself was seen, a simple conical mass with a white cloud drifting away from the top, appearing and disappearing at intervals.

The next day we had left the smooth, shallow, green seas through which we had passed ever since rounding Acheen Head at the N.W. end of Sumatra and were bouncing about in deep blue water as the 'Egeria' steamed slowly south against the wind. That day a sounding was made and bottom reached at 1400 odd fathoms.

At daylight on Friday, September 30th, Christmas Island was in sight. In the distance it appeared as a long dark strip against the sky with the sides rising moderately steeply, a shallow saddle in the

<sup>1</sup> A Report on the collections made on that occasion, including Captai Maclear's Report, appeared in the Proceedings of this Society for 1887 (p. 507



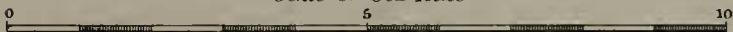
# CHRISTMAS ISLAND

*From sketches made in H.M. Ships "Flying Fish" & "Egeria"*

1887.

*N.B. The inland cliffs are not represented*

Scale of Sea Miles



*Figures on the land are heights in feet*





J. Smit del et lith.

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ZOSTEROPS NATALIS.



middle, and two low rounded elevations, the highest part near the western end. On nearer approach the whole island was seen to be uniformly covered with bush, except where a line of inland cliffs showed a bare grey face in places.

## II. PHYSICAL FEATURES.

The general physical features of the island are treated of in Captain Aldrich's Report<sup>1</sup> and in a paper by Captain Wharton, R.N., read before the Royal Geographical Society in June, 1888. I may here recapitulate some of the more important details.

Christmas Island, as will be seen by the map exhibited (Plate XXVI.), is of an irregularly quadrilateral shape, the angles being produced into more or less projecting promontories which point roughly to N.N.E., S.S.E., W.S.W., and N.W. The western side is much the shortest, the other sides being of nearly equal length. The northern shore forms a long sweeping curve from N.W. Point on the west to Rocky Point on the east. Just to the west of Rocky Point there is a small sheltered bay, called "Flying-Fish Cove," in which the 'Egeria' remained, made fast to the bottom and to a tree on shore, until she made the tour of the island previous to her departure.

The greatest length measured from Steep Point on the east side to Egeria Point on the west is about 12 statute miles, or half the length of the Isle of Wight. The island rises from deep sea; soundings of over 1000 fathoms were obtained at five points round it, all within four miles of shore.

The island is proved to be of volcanic origin by the presence of stones, found at the foot of a cliff in Flying-Fish Cove, pronounced by Mr. John Murray to be "compact olivine basalt, and of a bed of altered stones near the summit"<sup>2</sup>. No volcanic rock was, however, found *in situ*. Over every part of the island visited, except on the patch of small volcanic stones near the top, the surface rock is a hard limestone. This forms the summit, 1195 feet above the sea, and covers the sides, broadening out at successive elevations into terraces which rise one above another engirdling the island. These terraces have level tops and end to seaward in a rough steep descent, which in some places amounts to a cliff. The rock is traversed by innumerable broad and deep fissures, which run in all directions, isolating tall pinnacles, which may reach 12 or 20 feet in height. The surface is grey and weathered into minute irregular hollows and sharp projecting points and ridges.

On the way up to the summit from the landing-place, near the western end of the northern bay, three terraces are met with; the first is nearly a quarter of a mile from the shore and terminates in a vertical cliff about 85 feet high, the upper ones in steep slopes of less elevation.

<sup>1</sup> Report on Christmas Island (Indian Ocean), H.M.S. 'Egeria,' 1887.

<sup>2</sup> See Report on Christmas Island, pp. 14-15.

I believe that these terraces, though in a general way continuous round the island, except at the headlands, do not correspond at different places terrace for terrace.

It was not easy to settle this question, as the slopes were all covered with trees, and travelling over the sides of the island was most difficult.

I once, however, had a good opportunity of forming an opinion on the matter, on an occasion I shall long remember. I had started about sunrise from the ship in Flying-Fish Cove to go to the western landing. It was a deliciously fresh morning, and as we sped along over the blue water a school of porpoises came plunging alongside of us, while overhead a flock of Frigate-birds, Gannets, and Boobies kept us company, the last often flying so near that the men hit at them with boathooks. As the sun rose over the island the light struck obliquely along the northern side, lighting up the trees on the terraces while the steep slopes were still in shadow. I then saw that the lines of shadow, though in the main horizontal, frequently broke up and joined with one another, showing, as I believe, that the individual terraces are not continuous at the same level on the sides of the island.

At the headlands the higher part of the island generally terminates in a sheer cliff, from the foot of which a gradual slope extends to the sea. This inland cliff and the slope below it are repeated again and again in the contours of the projecting headlands as they are seen looking along the shore. The low foot of rock extends almost all round the island and ends in a shore-cliff, which varies in height from 15 to nearly 60 feet. It has an abrupt vertical face and is much underworn by the waves and traversed by fissures which penetrate far into the rock and in some places give rise to blowholes from which columns of spray shoot up at intervals from among the green bushes which cover the surface.

This shore-cliff is obviously made of coral, but the structure has begun to be obliterated by the deposit of lime in the interstices. This was most clearly seen in one place where some large oval boulders of coral, one of which measured 7 ft. 3 in. in transverse circumference, had been tossed up to the top of the shore-cliff (here about 15 feet from the mean sea-level) and had worn out hollows in the rock. The contrast between the clearly defined structure of the boulders and the partly obliterated characters of the coral which formed the cliffs shows that the change is here in progress which has converted the reefs of the upper terraces into a compact hard rock in which very little sign of their origin is visible.

In many places deep water extends up to the cliffs. At the western landing-place and at Flying-Fish Cove was a beach of rolled fragments and shells, then a narrow flat strip of dead coral strewn with lumps carried by the waves, beyond this a narrow line of growing coral-reef sloping down rapidly to deep water, on which as we approached the shore the beds of living coral could be seen, separated by tracts of white sand.

## III. GEOLOGICAL HISTORY.

The geological history of the island appears to be as follows:—The summit of the submarine volcanic mass has been slowly elevated above the sea to a height of nearly 1200 feet, and as it passed through the zone of lime-forming organisms in shallow water these have invested it with a cap of limestone. The upheaval has been arrested at intervals and allowed the formation of reefs which have since been elevated and form the terraces at the sides. At the projecting headland, where the chief stress of the ocean-currents fell, the reefs have grown less than in the intervals between them; and since their elevation the action of the waves has been greatest at these points; hence we find that at the headlands the terraced slopes are replaced by a single abrupt descent. At the head of Flying-Fish Cove, however, there is a single high cliff replacing the terraces, though it is protected by a spur sent down on either side, which end in Rocky Point to the east and Smith's Point on the west. This is, perhaps, due to the conformation of the volcanic basis which underlies the limestone.

Captain Wharton points out (*op. cit.*) that the raised reefs forming the summit of Christmas Island are the highest that are known in the world.

I have already said that the island is covered with dense bush. It extends often from the edge of the shore-cliff, where the branches reach out over the sea, to the summit. Hence, it is impossible to obtain any general view over the island, even from the top, and several interesting points as to its inland conformation remain at present undecided.

There was no sign of standing water or of stream-beds. All the rain that falls, and from the fresh greenness of the vegetation there is evidently an abundant rainfall, soaks at once into the porous limestone-rock and finds its way to the sea below the surface. There is, however, a patch of rounded pebbles near the summit which are described by Mr. Murray as "very much altered volcanic stones, many of them coated on the outside by peroxide of manganese;" they have no earth about them and cover an ill-defined oval area about 38 yards in length, and 10 yards in width, the long axis in the direction of the gentle slope of the surface at this part. It is covered with a bed of tall ferns (*Nephrolepis acuta*). It occurred to me that after heavy rains there may be a spring at the upper part of this area, the water reaching the surface here but sinking in again beyond it.

## IV. VEGETATION.

The shores are fringed with widely-spread littoral plants:—*Hibiscus tileaceus*, with its beautiful crimson-edged yellow flowers; *Tournefortia argentea*, a large silvery-green shrub with racemes of closely crowded small white flowers; while on the shore-cliff grew *Scavola koenigii* in bright green rhododendron-like masses, with white flowers, the favourite haunt of a brown and white Butterfly, *Vadebra macleari*,



which is peculiar to the island. Almost impenetrable thickets of a species of screw-pine grow on the shore-cliff in many places, and beds of another species with long arching leaves, more than six feet in length, often occur in the higher part.

Within the line of shore-plants the high bush begins and extends to the summit. Many of the trees are of great size, frequently, I believe, attaining 200 feet in height. Several of them send out buttresses at the base, which often stretch far out from the tree along the ground. This was particularly noticed in one of the tallest trees, which always went by the name of "the buttress-tree." We only found it in fruit and young bud, but Prof. Oliver tells me that it belongs to the Order Myrtaceæ, and is a species peculiar to the island. Another Myrtaceous tree, *Barringtonia racemosa*, was conspicuous with its beautiful hanging racemes of white flowers. *Erythrina indica*, a Leguminous tree with fine clusters of large crimson flowers, also occurred, and a Rubiaceous shrub, *Randia densiflora*, with small whitish fragrant flowers, was common. Many kinds of epiphytal and climbing plants were abundant, among which a new species of *Hoya* (the wax-flower of greenhouses) was one of the most conspicuous, festooning the trees and rocks with its shining fleshy leaves and hanging umbels of crimson and pink flowers, and its tough though slender stems formed one of the commonest obstacles to our progress through the bush.

The great Birds' Nest Fern (*Asplenium nidus*), with its fine crown of long arching fronds, was one of the greatest ornaments of the woods, growing on a fallen tree or high aloft on a branch.

Altogether some 50 species of flowering plants were obtained. These have been examined at Kew, and several appear to belong to new species. Sixteen kinds of ferns were collected, and two of them, an *Acrostichum* and an *Asplenium*, are peculiar to the island.

In concluding this brief account of the plants of Christmas Island, I may mention a minute myxomycetous fungus which was growing on a damp log. When I brought it home and showed it to my father, he pronounced it to be *Dictydium cernuum*, a specimen of which, as it happened, he had obtained two days before in a wood near London, a remarkable instance of the wide range of these minute spored organisms.

## V. MAMMALS.

PTEROPUS NATALIS, Thomas, P. Z. S. 1887, p. 511, pl. xli.

Specimens of this fruit-eating Bat were obtained during the visit of the 'Flying-Fish,' and so named by Mr. Oldfield Thomas, who found it to be a new species, most closely allied to one from Lombok. There was a tree in Flying-Fish Cove where they used to hang up during the day, but some were often seen flying over the tree-tops in bright sunlight, and then they appeared of a rich brown colour, owing to the semitransparency of the wings.

A small insectivorous Bat also exists on the island (seen by Dr. Dunlop, R.N., and myself), but no specimens were obtained.

*CROCIDURA FULIGINOSA*, var. *TRICHORA*, Dobs.<sup>1</sup>

This small Shrew-Mouse was very abundant in the woods, and their short shrill squeak was often heard all round as one stood quiet among the trees. I caught two in a pitfall at the top of the island, and another near the shore in a trap.

*MUS MACLEARI*, Thomas.

This Rat abounds all over the island. From dusk till daylight they swarmed about the tents on shore, and Captain Aldrich, who, with his party, spent a night on the high part of the island, found them equally abundant there. They generally keep to the ground, but are able to climb trees.

In the mouth of one of those that I shot I found a small green fruit held between the teeth.

*MUS NATIVITATIS*, Thomas.

This second kind of Rat was rather less abundant, and I only obtained two specimens. These were shot on the shore among the others, which they seemed to resemble in habits.

## VI. BIRDS.

Only seven kinds of land-birds were found on the island. The seventh was added to the list on the fifth day of our visit, and the remaining five days brought no new ones; hence it seems likely that there are not many species remaining to be discovered.

All these seven species are peculiar to the island, though some approach their allies in the archipelago very closely.

*MERULA ERYTHROPLEURA*.

*Turdus erythropleurus*, Sharpe, P. Z. S. 1887, p. 515.

This bird was common all through the bush. As one was examining rotten wood for Beetles, &c., they would often come close and watch our operations with a bright curious eye, and Captain Aldrich has described how one picked a grub from within a foot of his hand. It is a handsome bird, with fine ruddy flanks and brown back. The male has an ashy grey breast and a bright yellow bill.

I heard nothing that could be called a song. They often give a shrill sibilant note as they fly off, which may be followed by a *chuck-chuck-chuck*, and they often repeat a short *chick* six or seven times, quickening at the finish.

An old nest was found built in the angle of a number of ascending branches of a sapling. It is made of decayed wood and leaf-mould, caked together into a tenacious mass, covered on the outside with a beautiful green moss-like *Hepatica*, which is common on the tree-trunks, and lined with the black hair-like palm-fibres made use of by the *Zosterops* for the same purposes.

<sup>1</sup> The mammals are described in Mr. Thomas's paper, *infra*, p. 532.

Unfortunately no birds in young plumage were obtained, though one with a mottled breast was seen.

A partially immature female of this bird was obtained during the visit of the 'Flying-Fish' to the island, and described in the Report on that collection by Mr. Sharpe<sup>1</sup>. We obtained adult birds of both sexes, and from these it is evident that the species must be referred to the genus *Merula*.

The closest ally of the Christmas-Island Thrush is not very easy to determine. *Merula javanensis* is the nearest species geographically, but its uniform dark brown head and breast are very different from the white chin, grey breast, and crown uniform with the "ashy olive brown" back of our bird. *M. chrysolaus* from China, which in winter is said to range as far south as Luzon (the most northerly of the Philippines)—seems to be more closely allied, but the male of this species has a black throat. The bird that most closely resembles it is *M. vitiensis*, from the Fiji Islands, which, indeed, only differs in having the white below the head limited to the chin, not extending as far as the breast.

No member of this group of Thrushes has been hitherto found in the Austro-Malay region or in Australia.

*ZOSTEROPS NATALIS*, sp. n. (Plate XXVII.)

*Supra olivaceo-viridis, ad rostri basin flavescens; tergo vix fuscescentiore; annulo circum-oculari conspicuo; loris nigricantibus, supra pallidioribus limbatis; regione parotica cinerescente; subtus albescens, lateribus fuscescentibus; subcaudalibus dilute sulphureis; rostro nigro ad mandibuli inferioris basin plumbeo; pedibus plumbeis.*

Bill black, except the base of the lower mandible, which is slate; crown and nape yellow-olive, yellower towards the bill; eye-ring distinct, interrupted at the anterior canthus by the lore; lore black, the black feathers being continued below the eye-ring as far as the middle of the pupil. A short pale yellow band extends along the upper edge of the lores from the bill to the eye-ring; ear-coverts grey, shading into black in front, and into the green nape behind; mantle a slightly browner shade of olive than the crown, passing into the rather yellower rump and upper tail-coverts; throat and middle line of under surface white, shading into pale buff at the sides of the chest, pale cinnamon-brown on the flanks; legs slate; lower tail-coverts pale yellow; tail brown above, yellowish olive on the outer edges of the rectrices, pale brown below; wings above, upper coverts, and outer borders of the quills, except the first, olive-green; the rest of the quills dark brown; shafts black, the inner ones brown. Below: lower wing-coverts white, tinged with green; quills brown, with a pale inner border; shafts white; edge of wing dark brown, nearly black. The feathers on the upper and lower surfaces of the body are dark slaty grey at the base.

<sup>1</sup> P. Z. S. 1887, p. 507. "Report on Collections made by H.M.S. 'Flying-Fish' at Christmas Island."

The plumage of a young bird is similar to that of the adult.

Length of bill (from the front of the crown) . .	11.5 mm.
Base of bill to tip of tail . . . . .	4 $\frac{1}{4}$ in.
Tail . . . . .	1 $\frac{7}{8}$ in.
Wing . . . . .	2 $\frac{3}{8}$ in.

This *Zosterops* is, I suppose, the commonest bird on the island. The first note I heard on penetrating through the line of Hibiscus trees into the higher bush at Flying-Fish Cove was a short chirping proceeding from a party of them busy among the leaves and twigs above my head. I soon held one in my hand, and saw by the white ring round the eye that it was a species of *Zosterops*. I never heard any other note than this. The parties of them included young birds at the time of our visit, so perhaps it was the silent time with them, as some species have quite a melodious song. Two of their nests were found supported on the sides by horizontal branches, to which they were attached by vegetable fibres and the strong yellow web of a large Spider which is common in the bush. They are built of fibres and leaf-skeletons, fastened together with the same yellow material and with the white web of another kind of Spider, and lined with the black hair-like fringes of the leaf-sheaths of a palm (*Didymosperma porphyrocarpa*)<sup>1</sup>.

The bird is olive-green above, with grey ear-coverts, and white below, the flanks being pale cinnamon.

The genus *Zosterops* contains over 90 known species, and almost every year adds new ones to the list. These are distributed over a wide area, from Senegal and the Bight of Benin on the west to the Friendly Islands on the east, and from North China to New Zealand, Victoria, and Western Australia. A large number of the islands between these limits have their peculiar species, the Malay Archipelago being richest, while the continental areas, Africa, India, the eastern part of the Palæarctic Region and Australia are inhabited by a few wide-ranging forms.

The great majority of the species have the breast alone, or the breast and belly, bright yellow.

The closest ally of our bird is *Z. mysoriensis*, Meyer, from the Island of Mysori in Geelvink Bay, New Guinea. From this, however, it differs in the following points:—

1. The crown becomes paler towards the base of the tail.
2. The eye-ring is distinct<sup>2</sup>.
3. The lore is black and bordered above with a light streak, while *Z. mysoriensis* has the lore obscure and not so bordered.
4. The breast is white in the middle, not grey.
5. The flanks are brown, not grey.

<sup>1</sup> Cf. the account of the nest of *Z. palpebrosa* in Legge's 'Birds of Ceylon, p. 584.

<sup>2</sup> The only specimen of *Z. mysoriensis* that I have seen (in Canon Tristram's collection) appears (but the plumage is rather worn) to have no ring of white feathers round the eye. Salvadori makes no mention of the ring, though especially alluding to it in the allied species *Z. fuscifrons* and *Z. hypoleuca*.

6. The ear-coverts are grey, not olive-brown.
7. The edge of the wing is nearly black, not pale.
8. The general colour above is a brighter olive.
9. The bill is longer and more slender.

*Z. atriceps*, Gray, *Z. fuscifrons*, Salvad., *Z. hypoleuca*, Salvad., which, along with *Z. mysoriensis*, form a small group in the neighbourhood of New Guinea and the Moluccas, have the dark coloration on the crown of the head more strongly marked than the present species, a character which distinguishes them from the rest of the genus. *Z. albigularis*, Gould, from Norfolk Island, is very similar in colouring to our bird, and is, I believe, the only other species which has grey ear-coverts. The olive-brown on the head, and the cinnamon flanks are, however, much more strongly marked than in the Christmas-Island form.

COLLOCALIA NATALIS, sp. n.

*C. neglectæ* (Gray) *similis, sed plumis uropygii limbo albedo sublatiore; gula obscurius fuliginosa; areolis albidis subcaudalium minoribus.*

This small Swift was frequently seen hawking along the line of shore-bushes at dusk, or among the tops of the high trees on the summit of the island. No nests of it were seen.

It belongs to the same group as that which builds the edible nests in Java and elsewhere.

This bird is only separable from *C. neglecta*, Gray<sup>1</sup>, from Timor, by the following rather small differences:—

1. There is less white mingled with the dark metallic green on the lower tail-coverts.
2. The white spots at bases of the outer rectrices are less sharply defined.
3. The fuliginous colour of the throat is darker.
4. There is rather broader white edging to the rump-feathers.

In the first and third characters it is nearer *C. esculenta* (Linn.), but in the duller and browner metallic green of the upper surface it exactly resembles *C. neglecta*, and is quite distinct from that more brightly coloured species.

CARPOPHAGA WHARTONI, Sharpe, P. Z. S. 1887, p. 515, pl. xliii.

Mr. Sharpe's description of this bird was drawn up from a specimen which had been sent home in spirits of wine and which had lost much of the fine metallic gloss which is present in skins which have not been so treated.

The back and wing-coverts are rich dark bronze and bronzy green, slate when the back is viewed from behind, and held away from the light, and the whole upper aspect of the tail is dark glossy bronze-green, its under aspect being dark brown, with the lateral rectrices pale brown. There are 14 rectrices, as usual in this genus; the crown is slate, varied with iridescent lights, behind shading into

<sup>1</sup> G. R. Gray, "On the Genus *Collocalia*," Ann. Nat. Hist. xvii. 3rd series.

the fine bronze-green of the nape, and in front becoming paler towards the base of the bill, the most anterior feathers being almost white. The nostrils are oval and point upwards and outwards.

*Carpophaga whartoni* is a very abundant bird on the island, and as it was excellent eating and very tame, a large number were shot. It is about the size of the Wood-Pigeon (*Columba livia*). The general colour is dark, with rich metallic green and bronze lights on the back, dark purplish slate below, and conspicuous chestnut under tail-coverts.

A young bird which was shot resembled the adult in plumage.

They give a long *croo-croo-croo*, rather low. There is another note which we very frequently heard in the woods, and which I do not doubt was made by these birds, though I never succeeded in seeing one make the noise. It was a deep sound, like the distant lowing of cattle, *do-o-o-o-o*, and sometimes *dooooo—too-dooo—too-doo—too-doo*.

During the day the birds would often sit motionless for a long time among the high leafy branches, occasionally uttering the low notes. Towards sunset they congregated on the trees that were in fruit to feed. The stomachs (which are thin-walled) contained various fruits.

The oil-gland is bare of feathers. The gizzard is thin-walled, and the lateral opposing surfaces are covered with thin horny scales<sup>1</sup>. The intestine is capacious (the duodenum is 1 inch in diameter when flattened out); it is 27½ inches in length, and the cæca are absent. The *ambiens* muscle, though present, is rudimentary, being reduced to a slender band of muscle, less than 2 millim. in breadth, which arises by a tendinous origin from the pelvis immediately below the acetabulum, and ends in a delicate tendon which traverses the extensor tendon of the knee in the usual manner.

This is a quite distinct species from the others making up the large genus *Carpophaga*. Its closest ally appears to be *C. vanwycki*, Cass., a wide-ranging Pacific form apparently, as it is recorded in Gray's 'Hand-list' from New Island (S.W. of the Society Islands), while a specimen in Canon Tristram's collection is from Duke of York Island (north of the Samoa group). With this it agrees in the shape of the bill and nostrils and the colour and arrangement of the feathers at the base of the bill, in the fine texture of the feathers on the neck, the absence of an abrupt change of colour between the neck and back, and, though this is a common feature, in the chestnut under tail-coverts. *C. whartoni* differs from *C. vanwycki*, however, in the following characters:—

1. The much darker colour of the head, nape, and underparts, which are in *C. vanwycki* delicate pale grey.

<sup>1</sup> Mr. Thiselton Dyer, who has very kindly undertaken the examination of the seeds contained in the gizzard of this Pigeon and of the *Chalcophaps*, tells me that they consist, in this bird, of the fruits of the high "buttressed tree" (*Eugenia*), of a sapotaceous plant, possibly *Sideroxyylon*, and of an araliaceous plant not contained in the collection.

2. The dark metallic colours of the back are not washed with grey.

3. It is a larger bird, the wing measuring 10 inches (against  $9\frac{3}{4}$ ).

*C. vanwycki* is included in Gray's 'Hand-list' in the section of the genus named *Globicera*, but there is no sign of the tumidity at the base of the bill in it or in *C. whartoni*. This section includes some ten species which, with the exception of *C. myristicivora*, which ranges over the whole Indian Archipelago, are confined to the Austro-Malay and the Pacific Islands.

CHALCOPHAPS NATALIS, sp. n.

*Inter C. indicam et C. stephani media; C. indicæ similis, sed rostro fortiore, macula pallida alæ minore, femine uropygio, supra- et subcaudalibus fuscis, haud nigris. A C. stephani differt maris fronte albida, et tergo et alis æneo-viridibus.*

This is also an abundant species; until the last day of our stay in Flying-Fish Cove I had supposed that this was, unlike the others, a shy bird, as we had only come across it now and then, moving restlessly among the trees. I expect, however, we had really overlooked it. On that morning I had gone ashore to shoot good specimens of the *Merula* and *Zosterops* for skinning. On one occasion I stood in one place for about an hour, and during that time I saw three or four pairs of this Pigeon. They were picking up fallen fruits from among the brown and green leaves which were strewn beneath the trees; and here, where their brown and bronze-green plumage rendered them inconspicuous, they were so tame that the only difficulty I had in shooting them was to get far enough off and yet not lose sight of them among the crowded stems by the trees. Thus their habits appear to be strikingly in accordance with their protective colouring. In the trees, where their colour renders them conspicuous, they are restless and easily alarmed; while they appear to regard the ground as a place of safety.

Their note is, I believe, a *cooo-coo-cooo*, with hardly any roll of an *r* sound in it.

This appears to be an intermediate form between *C. indica* (Linn.) and *C. stephani* (Homb. & Jacq.).

Without giving a full account of it, I may point out that it resembles *C. indica*<sup>1</sup>, except in the following points:—

1. The bill is stouter.
2. The white and pale slate streak on the shoulder is smaller.
3. The rump, upper and under tail-coverts of the female are brown, not black.

In the last character it agrees with *C. stephani*, but differs from it in the following points:—

1. The crown of the male is white, not uniform with the rest of the head.
2. The metallic green upper surfaces of the wings are united by a broad band of green across the back.

*Chalcophaps indica* ranges from Ceylon and India as far north as

<sup>1</sup> *Vide* Legge's 'Birds of Ceylon,' p. 714.

Formosa and through Borneo and Celebes to Lombok and Flores. *C. stephani* is found in Celebes, New Guinea, Waigiou, and Mysol.

*UROSPIZIAS NATALIS*, sp. n.<sup>1</sup>

*Ad. Supra plumbeo nigricans, cervice rufo-brunnea excepta; alis caudaque fusco adumbratis; remigum pogoniis internis et re-  
ctricibus obscurius fasciatis; regione malarum plumbeo-cinerascente; mento pallido; pectore rufo-brunneo plumbeo transverse striato; abdomine pectore pallidior, albido conspicue anguste transverse striato; subcaudalibus fasciis albidis latioribus.*

*Jr. Supra obscure fuscus, tergo re-ctricibusque alarum rufescenti-brunneo maculatis; cervice albida maculosa; remigibus et re-ctricibus obscurius fusco fasciatis; gulu albida, in longitudinem obscure fusco striata; pectore, abdomine, lateribus subcaudalibusque albidis, rufo-brunneo transverse fasciatis, fasciis obscure fusco limbatis; cruribus fulvescentibus albido fasciatis.*

*Adult.* Crown dark slate; nape rufous brown; back, scapulars, upper wing-coverts, and upper tail-coverts dark brownish slate, paler on the tips and inner webs of the quills. The inner webs of the primaries and secondaries are obscurely barred with a darker shade. Towards the bases of the outer primaries and inner secondaries the interspaces between the bars are white or freckled with white. Tail, above, dark slaty brown, all but the two central feathers slightly paler on the inner webs and obscurely barred with a darker shade towards the bases of the outer rectrices, the intervals between the bars are, as in the wing, white or freckled with white; below, the two central feathers are uniform pale ashy brown. The side feathers are paler and rather obscurely barred with a darker shade, the bars being most distinct near the shafts and towards the ends of the feathers. The outer ones are obscurely freckled with white at the bases of the inner webs. Ear-coverts slate-grey; chin, general effect pale rufous grey, paler in the male; the shafts are black, the webs irregularly barred with slate and pale rufous. Breast fine rufous brown barred with slate; belly paler brown, with narrow pale bars of white more or less freckled with slate; under tail-coverts like the belly, but the white bars broader; flanks and legs like the belly, but the pale bars less distinctly marked, sometimes absent, but the feathers are always tipped with white. Wings, primaries dark grey-brown, pale grey towards the base; secondaries grey, darker towards the tips, and barred and mottled with dark and white in correspondence with the colour on the dorsal aspect; lower wing-coverts white, barred and

<sup>1</sup> Anatomically the species agrees with its allies in the characters mentioned by Garrod. There is a nude oil-gland and 12 rectrices are present. The gall-bladder is absent. The gizzard is very muscular and the lining is raised on the opposing surfaces, which are sharply defined, into nine well-marked regular ridges with their planes in the direction of the axis of the gullet. It contained the hard albuminous seeds of some monocotyledonous plant, partly broken up. The intestine is 20 inches in length and is not provided with cæca.

An ambiens muscle is present, though of extreme tenuity; a small muscular belly not more than 1 millim. in breadth is interposed between the tendinous origin and the long slender tendon which passes over the knee.



mottled with pale rufous and slate; edge of the wing white, little mottled in the oldest specimens.

*Young.* Crown dark brown in the middle, the feathers of the sides, in a line extending from the cere back to the ear-coverts, and of the ear-coverts dark brown in the centres, pale yellow at the sides; nape, at the upper part mottled dark brown and white (produced by dark brown tips and shaft-streaks to white feathers), at the lower mottled brown and pale yellow; back and upper wing-coverts dark brown, mottled with rufous brown; shoulders rich burnt sienna mottled with dark brown. Quills, the outer webs and the ends are dark brown, the inner web shading from brown through pale reddish brown to pale yellow, the tips of all and the outer margins of the secondaries pale brown, the whole barred with dark brown, the bars fading away before reaching the inner margins of the webs; upper tail-coverts brown, becoming darker towards the ends, tips pale rufous brown. Tail above brown, the outer feathers resemble the wing-quills in the fact that the inner webs and the tips shade off to pale reddish brown; the whole barred with brown; the barring is least on the inner feathers, which have five bars limited to the terminal half of the feathers; on the outer feathers the bars are continued to the base of the web and are closer, amounting to 15-17 in number; below rufous grey, barred with dark as above, two central rectrices greyer. Chin and throat—the feathers are white, yellower towards the tips, with shaft-streaks of dark brown, linear, becoming lanceolate at the lower part of the throat. Breast, belly, lower tail-coverts, and flanks white, boldly barred with rufous brown, the bars are margined with darker brown, and are continued towards the tip of the feathers into an angular process extending a short distance along the shaft. Legs, feathers white or pale yellow, barred with tawny brown. Lower wing-coverts pale yellow, barred with tawny brown. Quills pale reddish brown, barred with brown as on the upper surface; primaries pale brown towards the ends.

#### Measurements.

	♂. in.	♀. in.
From base of bill to tail-tip . . . . .	13 $\frac{6}{10}$	16 $\frac{1}{4}$
Tail . . . . .	7 $\frac{2}{10}$	8 $\frac{7}{10}$
Wing . . . . .	8 $\frac{6}{10}$	10 $\frac{6}{10}$

*Urospizias natalis* is a common bird on the island. As we made our way through the bush one would often fly up to a branch or the top of a pinnacle of coral-rock and sit there ignorant of danger, as though inquiring the cause of this unusual disturbance in the woods. If there were two together and one was shot, the other would remain motionless or fly to another branch close at hand. One was knocked over with a stick and captured. It appeared to be little injured, and I kept it alive for some months, but unfortunately it died in fits before my return to England. The stomachs of those that were shot contained feathers of the *Zosterops* and the remains of lizards and large grasshoppers.

The adult birds are dark slate on the upper parts except for a band of rufous brown at the back of the neck. Below they are of a fine rufous brown, barred with white on the belly.

The bird belongs to the genus *Urospizias*<sup>1</sup> (the amended form of *Urospiza*, the name which Kaup applied to this group of Goshawks), which contains some 20 species. They are most numerous in the Austro-Malay region—where the Moluccas and Lombok mark the western limit of the range. Elsewhere species are found in the Marianne Islands, the Fijis, New Caledonia, Norfolk Island, and in Australia and Tasmania. There are several of these species to which the Christmas Island bird is closely related, though it differs from them as much as they differ from one another.

The nearest relation appears to be *U. griseigularis* from the Moluccas, from which it differs in adult plumage in possessing the crown of the head not paler than the back, the slate tinge on the upper breast, and the brown bars on the lower part of the belly and lower tail-coverts, sharply defined and edged with slate, not obscure and plain brown. The difference between the young birds is more marked. The Moluccan bird has the back almost uniform, not mottled, the throat with a median and two lateral lines of longitudinal streaks, the breast longitudinally streaked with brown and the belly with distant transverse bars which are uniform brown, not rufous, in the centre.

In the collection of the British Museum are two skins which, by the slaty tinge on the back and the indications of the rufous nape-band, are evidently acquiring the adult plumage. Among the worn longitudinally streaked feathers at the sides of the breast are new close-webbed ones which are white with brown pale-centred bars very like those on the breast of the immature Christmas Island bird. This appears to be an indication that the transverse barring of the underparts, which is found in the young plumage of several members of the group, is a later acquired character which many species never assume. The longitudinal streaking, on the other hand, which occurs widely in this family of birds, must on this view be regarded as the more primitive character. In our bird this stage appears to be passed over altogether.

#### NINOX NATALIS, sp. nov.

*Supra rufo-fulvescens, cervicis lateribus et supracaudalibus sparse pallide maculatis; fronte, loribus et mento pallidis; alis fuscis pallidius fasciatis, et fascia albida obliqua; tectricibus secundariis in poyoniis externis albido fasciatis; rectricibus fuscis, fasciis pallidioribus circa decem; subtus alba, rufo-fuscescente fasciata, fasciis interfasciisque æqualibus; subalaribus subrufo-fuscescentibus, obscurius maculatis; metatarso omnino plumis vestito.*

*Adult male.* Crown, nape, back, upper tail-coverts, and lesser upper wing-coverts uniform red tawny brown, with here and there an

<sup>1</sup> Cf. J. H. Gurney, 'List of the Diurnal Birds of Prey,' 1884.

obscure paler spot on the lateral parts of the nape and upper tail-coverts; the hidden bars of the feathers are slaty grey. The fore part of crown and lores clothed with long sparsely barbed white feathers with black shafts, except a narrow line of pale tawny feathers in the middle line, reaching to the base of the bill; ear-coverts duller brown than the nape, with white bases to the barbs; chin-feathers like those of the lores, but pale tawny and with white shafts. Greater secondary coverts same colour as the back, barred chiefly on the outer web with white, the white bars are bounded by darker brown; primary-coverts dark brown, obscurely barred with paler brown; edge of wing pale ochre; primaries dark brown, barred with lighter brown and with paler outer edges; the second to the sixth primaries have one or two interspaces conspicuously paler than the rest—these are so arranged as to form an interrupted line traversing the extended wing from before outwards and backwards. Tail dark brown, barred with ten rufous bands; in the outer feathers the contrast between the colours of bands and interspaces becomes more conspicuous. Throat pale rufous. Breast, belly, and flanks white, barred with scarcely blurred bands of the same tawny brown as the back; the feathers have a narrow shaft-streak of brown; the bars and interspaces are about equal in breadth; vent-feathers long and white. Under tail-coverts like the breast, but paler brown. Legs rufous ochre, mottled with rufous brown; they are clothed with feathers to the end of the metacarpus; toes sparsely covered with pale horn-coloured bristles. Under wing-coverts uniform tawny brown, paler than the back, becoming mottled towards the edge of the wing; the larger coverts are pale brown, changing to white at the tips of the feathers barred with ashy brown. Quills below brown barred with pale brown, the bars obscure towards the tips of the primaries. Cere tumid; the nostrils look forwards and outwards.

#### Measurements.

	in.
Crown to tip of tail . . . . .	10 $\frac{7}{10}$
Tail . . . . .	5
Wing . . . . .	7
Metatarsus . . . . .	1 $\frac{6}{10}$
Third digit to base of claw . . . . .	1 $\frac{1}{10}$

Only one specimen of *Ninox natalis* was obtained.

It is of a fine tawny brown colour on the back, and bars of the same colour alternate with white on the breast. It measures about 11 inches in length. The stomach contained feathers and bones.

A cry up among the woods (*ow-ow-ow*), like the distant barking of a dog, sometimes broke the stillness of the night, as we lay in Flying-Fish Cove. It was probably made by this bird.

This Owl belongs to group C of Mr. Sharpe's arrangement of the genus in the British-Museum Catalogue—a group characterized by the breast being spotted or transversely barred, not longitudinally streaked with brown nor uniform. The group contains 13 species,

which with one exception are confined to the Austro-Malay sub-region and Northern Australia. The exception is *N. superciliaris* (Vieill.) from Madagascar, a species which neither in appearance nor geographical distribution seems to be quite at home among the others.

The Christmas Island bird is closely allied to *N. forbesi*, Sclater, from Timor Lant. It differs from it in the following characters:—

1. The shade of the general brown colour of the plumage is a red tawny brown, as distinguished from the yellower duller colour of that bird.

2. The absence of the dusky shade on the crown.

3. The ground-colour of the upper breast is white, not tawny yellow.

4. The breadth of the bars below is equal to that of the interspace, not half their breadth.

*N. hypogramma* (Gray), from the Moluccas, is another near though more distant ally, the obvious difference being on the upper surface, which is dull brown, becoming ashy brown on the crown. *N. hantu*, from Bouru, and *N. squamipila* (Bp. Consp), from Ceram, are also allied, but sharply separated by the almost barbless bristles on their tarsi, as well as by other characters. *N. variegatus* (Quoy and Gaim.) is the only other species placed in this section of the genus (with crown of head uniform, not spotted). It is readily distinguished by its dull brown colour and spotted back, and by the presence of spots on the forehead.

Of these the first five species form a group which is characterized by similarity of size (10–12 inches in length), the uniform coloration of the crown of the head, and by greater length of the tail. With regard to this last point, if the *length of the tail* is compared with that of the *wing* the figures are as follows:—

	Length of tail. in.	Length of wing. in.	per cent.
<i>Ninox hypogramma</i> ..	5·5	9·0	61·1
<i>N. squamipila</i> .....	5·3	8·25	60·6
<i>N. hantu</i> .....	5·8	8·3	69·8
<i>N. forbesi</i> .....	5·3	7·7	68·8
<i>N. natalis</i> .....	5·0	7·2	69·7

all over 60°/°. Whereas among the smaller species with spotted crowns the figures are:—

	Length of tail. in.	Length of wing. in.	per cent.
<i>N. punctulata</i> (Quoy & Gaim.)	3·0	6·8	44·1
<i>N. granti</i> , Sharpe.....	4·1	7·0	58·5
<i>N. jacquinoti</i> .....	3·8	6·8	55·8

all below 60°/°. While for *N. variegata*, with its spotted forehead, they are 4·6, 7·9, 58·2. It therefore appears to hold an intermediate position.